

**Amendments to the Drawings:**

The attached 9 sheets of drawings represent formal versions of the previously filed drawings. These 9 sheets, which include FIGs. 1-6, replace original sheets including FIGs. 1-6.

Attachment: Replacement Sheets (9)

## **REMARKS**

Claims 1, 3-7, and 9-16 are pending in the application. Claims 17-22, withdrawn from further consideration by the Examiner, and Claims 2 and 8 are canceled. Claims 1, 3-5, 7, 9-10, and 13-15 are amended. Support for the amendments is found at least at Paragraphs 0020 and 0022-0024 and FIGs. 1A, 2A, and 6. No new matter is added.

## **INTERVIEW SUMMARY**

Applicants gratefully acknowledge the courtesies extended to Applicants' representative by Examiner Ruggles during the telephone interview conducted on June 8, 2006. During the telephone interview, Applicants' representative clarified that no substitute specification was filed. Instead, a copy of the specification accompanying the executed declaration filed May 7, 2004, was mistaken for an attempt to provide a substitute specification. Accordingly, Applicants respectfully submit that objections regarding substitute specification are rendered moot in view of the discussed clarification.

## **DRAWINGS**

The Office Action required new corrected drawings. Accordingly, replacement sheets including formal drawings corresponding to the informal originally filed drawings are submitted herewith.

The Office Action further objected to the drawings for failure to comply with 37 C.F.R. §1.84(p)(5). The specification is hereby amended to address the noted issues. Accordingly, Applicants respectfully request the withdrawal of the objections to the drawings.

### **SPECIFICATION**

The present amendment includes amendments to the specification to address minor informalities noted in the outstanding Office Action. As discussed above, as there was no substitute specification filed, Applicants respectfully note that the issue of non-entry of the substitute specification is rendered moot. Further, the title and abstract are amended. With regard to the title, Applicants respectfully note that certain disclosed embodiments include chrome, despite the assertion at page 3 of the Office Action that “the instant patterned phase shifting mask (PSM) [is] formed without any chrome. Thus, Applicants respectfully request the withdrawal of the objections to the specification.

### **CLAIM OBJECTIONS**

Claims 2-5, 7-8, and 10-16 are objected to because of the informalities. The Claims are amended to address the noted informalities, rendering these objections moot. Accordingly, Applicants respectfully request the claim objections be withdrawn.

## CLAIM REJECTIONS

### Rejections under 35 U.S.C. § 112:

Claims 1-16 are rejected under 35 U.S.C. §112, second paragraph. Although Applicants note that Applicants are entitled to be their own lexicographers (MPEP § 2111.01(III)) and that the claims are definite in the context of the written description and customary use by those skilled in the relevant art (MPEP § 2111.01(II)), Claims 1 and 9-10 are amended to address the Examiner's concerns for the sole purpose of expediting prosecution, and no change of scope is intended. Accordingly, Applicants respectfully request the claim rejections under 35 U.S.C. § 112 be withdrawn.

### Rejections under 35 U.S.C. § 102(e):

Claims 1-8<sup>1</sup> are improperly rejected under 35 U.S.C. §102(e) as being anticipated by Sivakumar et al. (US Patent Pub. No. 2004/0101765, herein "Sivakumar"). For the reasons discussed below, Applicants respectfully request the withdrawal of the anticipatory rejection.

Amended Claim 1 recites, *inter alia*, at least one equal line space phase shifting pattern including an annular ring and a central portion, wherein a mask pitch is smaller than two times of a corresponding critical dimension pitch on a semiconductor substrate. In a non-limiting exemplary embodiment, FIG. 1B represents a cross sectional view of FIG. 1 illustrating a pattern 110 characterized as an annular equal line space structure.

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<sup>1</sup> Claims 2 and 8 have been incorporated into Claim 1 and canceled in this Amendment.

Widths 120a and 120b of the annular ring 120, widths 130a and 130b of the annular ring 130, widths 140a and 140b of the annular ring, and the width 150a of the central portion 150 are approximately the same. (Specification at Para. 0020). FIGs. 2A and 2B illustrate an alternate non-limiting exemplary embodiment including only one annular ring and a central portion, where the widths 220a and 220b of the annular ring 220 and the width 230a of the central portion 230 are the same. (Specification at Para. 0021). As described in Applicants' disclosure, an appropriate mask pitch, such as 2 times of 120a, produces a corresponding dark region on a semiconductor substrate. Accordingly, a number of annular rings needed can be determined by the appropriate mask pitch. (Specification at Paras. 0023-0024).

Although the Office Action asserts that Sivakumar teaches Applicants pattern and mask pitch limitations in rejecting Claims 1 and 8, it is respectfully submitted that this rejection is improper on at least two grounds:

1. First, the rejection fails to meet the requirements of a proper rejection under 35 U.S.C. §102 as Sivakumar does not explicitly or impliedly teach every aspect of the claimed features (MPEP § 706.02(IV)).
2. Second, even under a standard of obviousness, the vague teachings of Sivakumar do not teach or suggest the features recited in amended Claim 1.

Sivakumar does not teach or suggest at least an equal line space phase shifting pattern including an annular ring and a central portion, wherein a mask pitch is smaller than two times of a corresponding critical dimension pitch on a semiconductor substrate. Instead, Sivakumar describes a CPL mask including a reticle having a plurality of phase-

shifting areas (mesas or recesses) interspersed with non-phase-shifting areas of the mask and arranged in a substantially alternating two-dimensional pattern. (Sivakumar at Para. 0026). For example, Sivakumar describes that the length of a rectangular element should be less than a feature length that causes multiple lines to be patterned. (Sivakumar at Para. 0030).

### **1. Improper anticipatory rejection:**

With regard to the improper anticipatory rejection, it is respectfully noted that, for a proper rejection under 35 U.S.C. § 102, the reference must teach every aspect of the claimed invention either explicitly or impliedly. Any feature not directly taught must be inherently present. (MPEP § 706.01(IV)). The Office Action asserts that Sivakumar, at Paras. 0004 and 0025, teaches a mask pitch smaller than two times of a corresponding critical dimension pitch. Specifically, the Office Action asserts that the simulated aerial image intensity distribution of FIG. 1 teaches a mask pitch of 200nm and that the exemplary line base width of 250nm teaches a critical dimension pitch. (Office Action at page 8). However, it is respectfully submitted that these isolated exemplary references do not constitute teachings directly corresponding to the structure of Sivakumar's CPL mask. Instead, Sivakumar clearly notes that a large variety of shapes and dimensions may be employed (Sivakumar at Para. 0030). Further, although Sivakumar notes that 100nm is an ideal simulated phase edge separation, Sivakumar leaves unclear the desirability of separation between 100nm and 500nm. (Sivakumar at Para. 0004).

Moreover, although Sivakumar provides an example line base width of 250nm, Sivakumar also notes, in accordance with the focus of Sivakumar's invention, that features such as pads have widths several multiples of the base line width. (Sivakumar at Para. 0025). Thus, in view of Sivakumar's broad teaching within Para. 0030, the disparate exemplary references to phase edge separation and base line width selected as teachings in the Official Action fall short of demonstrating that Sivakumar inherently teaches all limitations recited in Applicants' amended Claim 1.

## **2. Sivakumar still fails under obviousness standard:**

Further, even the broad description in Sivakumar fails to teach or suggest the features recited in amended Claim 1. Assuming, *arguendo*, that the recited mask pitch features are encompassed by the teachings of Sivakumar at Para. 0030, Sivakumar fails to suggest or imply any particularly advantageous configuration. On the other hand, Applicants advantageously provide the claimed features to enable the creation of a corresponding dark region on a semiconductor substrate where a number of annular rings needed can be determined by the appropriate mask pitch (Specification at Para. 0024). Drawing upon an analogy to the chemical arts, it is respectfully noted that the fact that a claimed species or subgenus is encompassed by a prior art genus is not sufficient by itself to establish a prima facie case of obviousness. (MPEP § 2144.08). Along the same lines, although the Official Action attempts to piece together disparate references to dimensions within the Sivakumar disclosure, Sivakumar does not teach or suggest any motivation to

select any particular species or subgenus. Therefore, absent additional teaching or motivation, Sivakumar's general description alone does not obviate Applicants' claimed mask pitch features.

Accordingly, for at least the above reasons, Applicants respectfully request the rejections of Claims 1-8 be withdrawn.

**Rejections under 35 U.S.C. § 103(a):**

Claims 9-15 are improperly rejected under 35 U.S.C. §103(a) as being unpatentable over Sivakumar in view of either Dao et al. (U.S. Patent No. 5,302,477, herein "Dao") or Schroeder et al. (US Patent Pub. No. 2003/0027057, herein "Schroeder"). Claim 16 is improperly rejected under 35 U.S.C. §103(a) as being unpatentable over Sivakumar in view of Lee et al. (U.S. Patent No. 5,240,796, herein "Lee").

In view of the previous discussion regarding Sivakumar and the features recited in amended Claims 9-10, Applicants respectfully submit that none of Dao, Schroeder, or Lee remedy the noted deficiencies in Sivakumar, which is asserted to teach Applicants annular equal line space phase shifting pattern. In particular, not one of Dao, Schroeder, or Lee is asserted to teach or suggest the features recited in Claims 9-10 regarding at least an annular equal line space phase shifting pattern or a mask pitch. Accordingly, Applicants respectfully request the withdrawal of the obviousness rejection of Claims 9-16 based on Sivakumar in view of any one of Dao, Schroeder, or Lee.



Furthermore, with regard to Claims 10-16, Applicants respectfully submit that the combination of Sivakumar with either one of Dao, Schroeder, or Lee is improper. Specifically, although Dao, Schroeder, and Lee are provided to teach chrome (and thereby, a layer of conductive material), Sivakumar's chromeless phase shift lithography CPL masks explicitly teaches away from any use of chrome. (Sivakumar at Para. 0036). Further, Sivakumar specifically notes certain disadvantages of chrome (Sivakumar at Para. 0006). It is noted that a proposed modification cannot render the reference unsatisfactory for its intended purpose or change the principle of its operation (MPEP § 2143.01(V),(VI)). As Dao, Schroeder, and Lee are each provided to modify Sivakumar to include a conductive/chrome layer, the obviousness rejections relying on these combinations or modifications are improper.

Accordingly, Applicants further respectfully request that the obviousness rejections of Claims 10-16 based on Sivakumar in view of any one of Dao, Schroeder, or Lee.

### CONCLUSION

As shown above, the rejections of the pending claims are improper and must be withdrawn. Applicants request allowance of the application including claims 1, 3-7, and 9-16.

If the Examiner has any questions relating to this response or the application in general she is respectfully requested to contact the undersigned so that prosecution may be expedited.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 04-1679 (Docket #TSMC2002-0629).

Respectfully submitted,

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